Unit 8 - Week 7 - Computer simulation of Rayleigh fading, Antenna Diversity

Assignment 7

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-09-18, 23:59 IST.

1) Given channel coherence time and coherence bandwidth are 2.5 us and 200 kHz respectively. 16-QAM modulation is used for communication to achieve 1Mbps throughput. Which of the following is true about the channel? *1 point*

- Slow fading, Frequency selective
- Fast fading, frequency selective
- Slow fading, Frequency flat
- Fast fading, Frequency flat

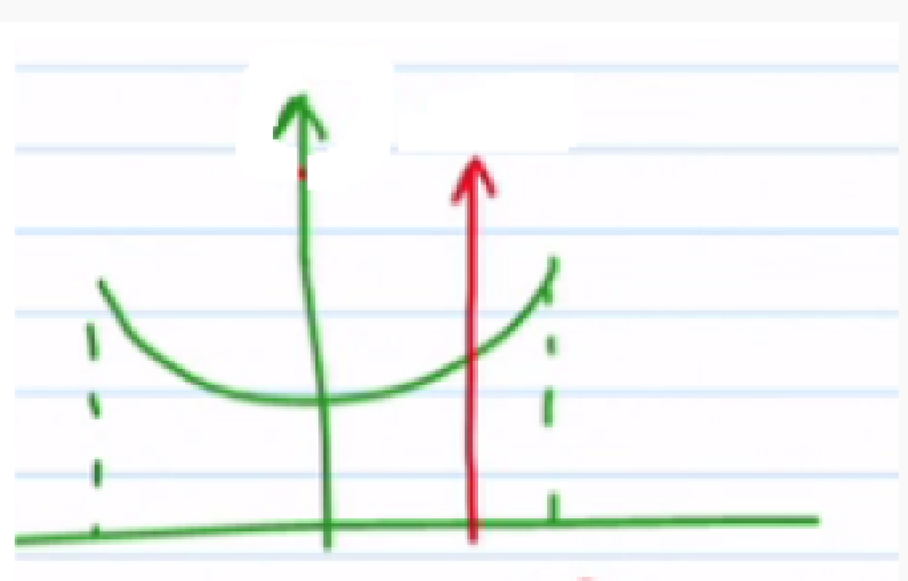
No, the answer is incorrect.
Score: 0
Accepted Answers:
Fast fading, frequency selective

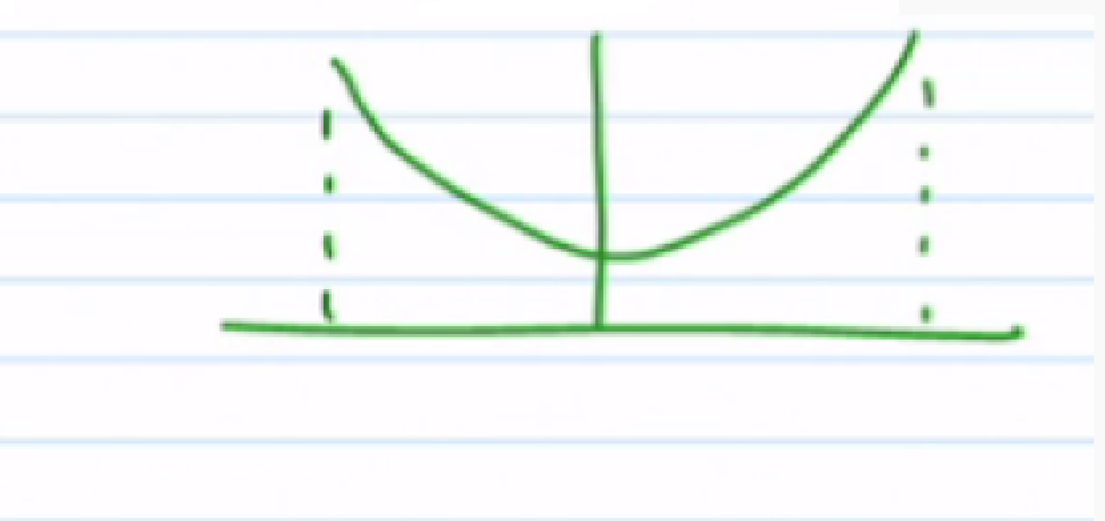
2) How would the above answer change if BPSK is used instead of 16-QAM. (consider 1Mbps throughput) *1 point*

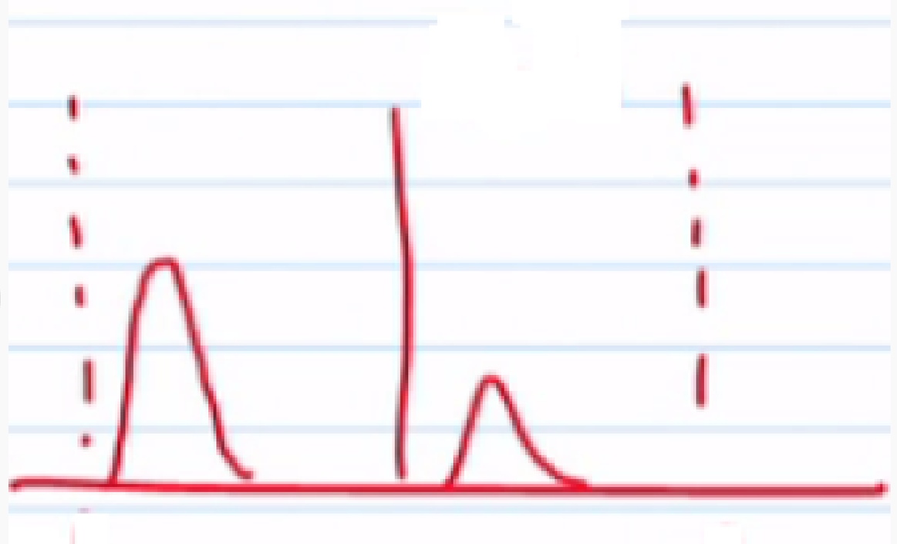
- Slow fading, Frequency selective
- Fast fading, frequency selective
- Slow fading, Frequency flat
- Fast fading, Frequency flat

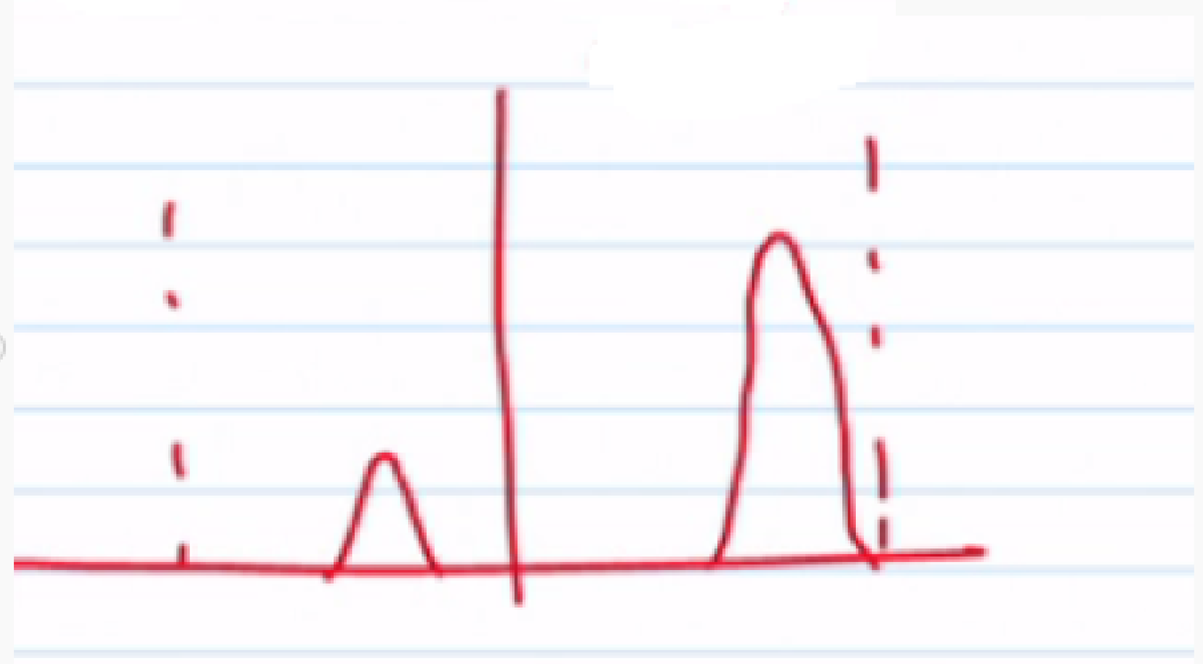
No, the answer is incorrect.
Score: 0
Accepted Answers:
Slow fading, Frequency selective

3) Which of the following spectral density plots refer to spectrum with an LOS component? *1 point*

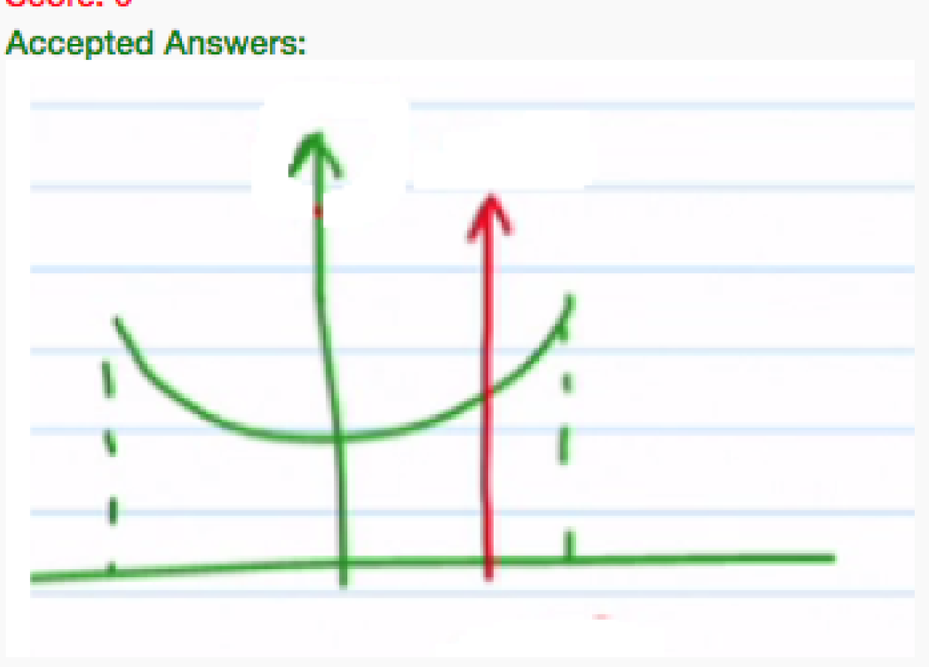








No, the answer is incorrect.
Score: 0
Accepted Answers:



4) You are asked to generate a Rayleigh fading channel and are aware of a method to generate a Rayleigh random variables and many independent random variables can be generated following that procedure. If so, what is the need to resort to methods such as Smith method or Clarke and Gans method? *1 point*

- (a) Independent random variables do not model the time correlation.
- (b) To reduce the computational complexity
- (c) Both (a) and (b)
- (d) None of these

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a) Independent random variables do not model the time correlation.

5) Given the maximum Doppler shift in a channel is 80 Hz. It is required to simulate the channel using Jakes model with 30 oscillators. Which of the following is not an oscillator frequency? *1 point*

- 80 Hz
- 79.89 Hz
- 79.74 Hz
- 79.55 Hz

No, the answer is incorrect.
Score: 0
Accepted Answers:
79.74 Hz

6) Which of the following is not true about the Walsh hadamard matrices? *1 point*

- Symmetric matrix
- Orthogonal matrix
- Anti-symmetric matrix
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
Anti-symmetric matrix

7) Which of the following is true w.r.t Smith method and Clarke and Gans? *1 point*

- Smith method requires less number of computations
- Clarke and Gans method has less computational complexity
- Both have same complexity
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
Smith method requires less number of computations

8) Consider a base station and a mobile system with two antennas. The transmission from base station is picked up by both the antennas which experience different channel conditions and hence different values of instantaneous SNR. The SNR for both the antennas is below the threshold at which the signal can be properly detected. Which of the following diversity technique(s) may lead to a proper detection of the signal? *1 point*

- a) Selection diversity
- b) Optimal diversity
- c) Both (a) and (b)
- d) None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
b) Optimal diversity

9) In the previous question, assume that one of the antennas experiences SNR which is above the required threshold while the other antenna does not. Which of the following diversity technique(s) will lead to a proper detection of the signal in this case? *1 point*

- a) Selection diversity
- b) Optimal diversity
- c) Both (a) and (b)
- d) None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
c) Both (a) and (b)

10) Selection diversity is not useful in which of the following scenarios. *1 point*

- All the antennas are weak
- Antennas are correlated
- The antennas are very close to each other
- All of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
All of the above

11) Consider a three antenna BPSK system. If only one of the antennas is used, it has a performance of $P_e = 3.87 \times 10^{-6}$ in an AWGN channel. Now, if all the three antennas are used with selection diversity, what will be P_e if it is experiencing Rayleigh fading? It is known that the minimum SNR required for successful reception is 4dB. Given $Q(\sqrt{20}) = 3.87 \times 10^{-6}$. Given the probability of bit error for coherent BPSK in AWGN channel is given by $P_{e,BPSK} = Q(\sqrt{2\gamma})$ where γ is the SNR. *1 point*

- 0.013
- 0.036
- 0.011
- 0.222

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.011

12) In an AWGN channel, which of the following diversity methods will be effective. *1 point*

- (a) Selection diversity
- (b) Optimal diversity
- (c) Co phasing
- (d) Both (b) and (c)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d) Both (b) and (c)

13) In Co-phasing diversity: *1 point*
Statement 1: The scaling constant G_k is chosen such that the weak antennas are given lower weightage.
Statement 2: The scaling constant G_k is chosen such that the phase dependence on SNR is eliminated.
Which of the following is correct?

- Statement 1 is False; Statement 2 is True
- Statement 1 is True; Statement 2 is True
- Statement 1 is False; Statement 2 is False
- Statement 1 is True; Statement 2 is False

No, the answer is incorrect.
Score: 0
Accepted Answers:
Statement 1 is False; Statement 2 is True

14) Co phasing was discussed in the lecture. Consider the case where cophasing is implemented using 4 receiver antennas. There are four signals $r_1(t), r_2(t), r_3(t)$ and $r_4(t)$ that will be combined here. Assume that the average SNR of each antenna is the same and is given by Γ. What is the average SNR i.e. $E[\gamma_{co-phasing}]$ for the combination of the 4 antennas in cophasing? *1 point*

- $\Gamma(1 + \frac{\pi}{4})$
- $\Gamma(1 + \frac{\pi}{3})$
- $\Gamma(1 + \frac{\pi}{2})$
- $\Gamma(1 + \frac{3\pi}{4})$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\Gamma(1 + \frac{3\pi}{4})$

15) Which selection diversity will you implement in a high noise system and why? Choose the option with the most appropriate reason. *1 point*

- Post Detection Selection Diversity, because all the SNRs are present and we can select the maximum.
- Pre Detection Selection Diversity, because only one Receiver is required compared to Post Detection Selection Diversity where many Receivers are required.
- Post Detection Selection Diversity, because even though more receivers are required we can be sure about the SNR value. RSSI is not a good measure of SNR in high noise system.
- Both Post Detection and Pre Detection Selection Diversity can be implemented as there is no difference between the two in a high noise system.

No, the answer is incorrect.
Score: 0
Accepted Answers:
Post Detection Selection Diversity, because even though more receivers are required we can be sure about the SNR value. RSSI is not a good measure of SNR in high noise system.

16) For the different diversity schemes *1 point*
Γ_{MRC} : Average SNR for MRC with diversity 2
$\Gamma_{cophasing}$: Average SNR for Co-phasing with diversity 3
Γ_{SC} : Average SNR for Selection diversity with diversity 4
Arrange Γ_{MRC} , $\Gamma_{cophasing}$ and Γ_{SC} assuming the average SNR of each antenna is same and is given by Γ.

- $\Gamma_{MRC} > \Gamma_{cophasing} > \Gamma_{SC}$
- $\Gamma_{SC} > \Gamma_{MRC} > \Gamma_{cophasing}$
- $\Gamma_{MRC} > \Gamma_{SC} > \Gamma_{cophasing}$
- $\Gamma_{cophasing} > \Gamma_{SC} > \Gamma_{MRC}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\Gamma_{cophasing} > \Gamma_{SC} > \Gamma_{MRC}$